



Techday

Taiwan | 2023

OUR TECHNOLOGY STARTS WITH YOU

**Sub-track II –
Power & Energy Presentation**



life.augmented

KNX energy management system

Eric Lo

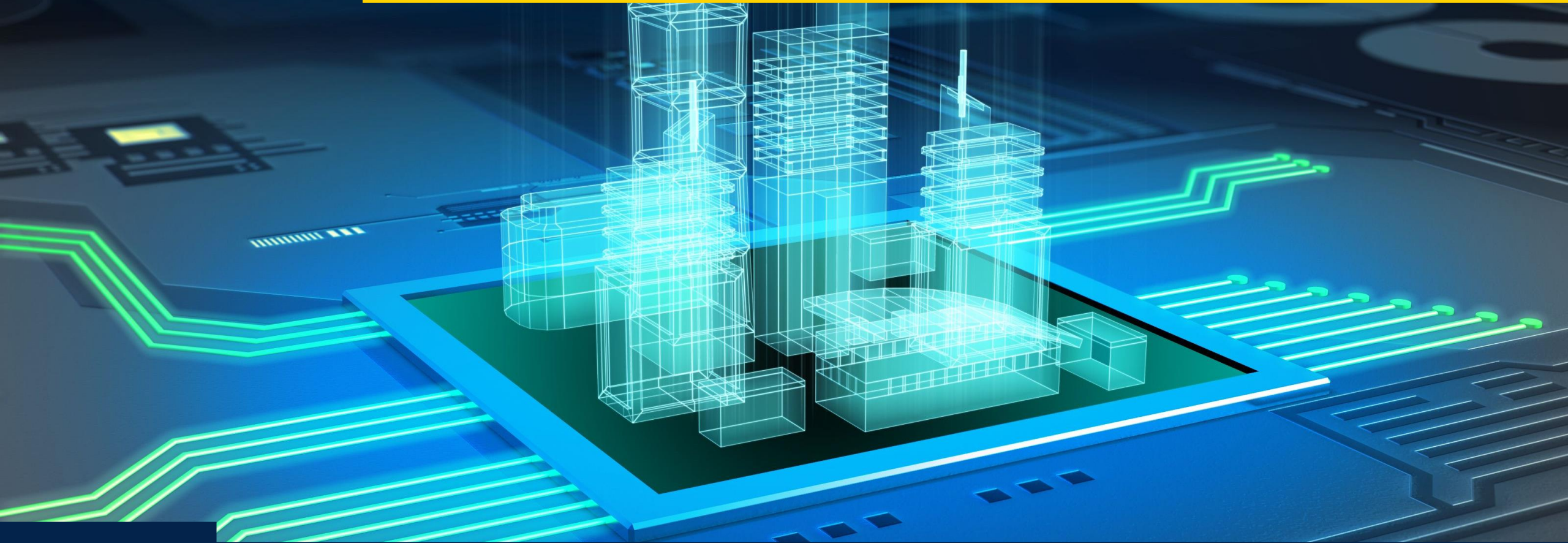
Automation Competence Center

STMicroelectronics

Agenda

- 1 KNX market and ST solutions
- 2 KNX energy management system
- 3 ST KNX EV charging station
- 4 ST KNX solutions and development process

KNX market and ST solutions



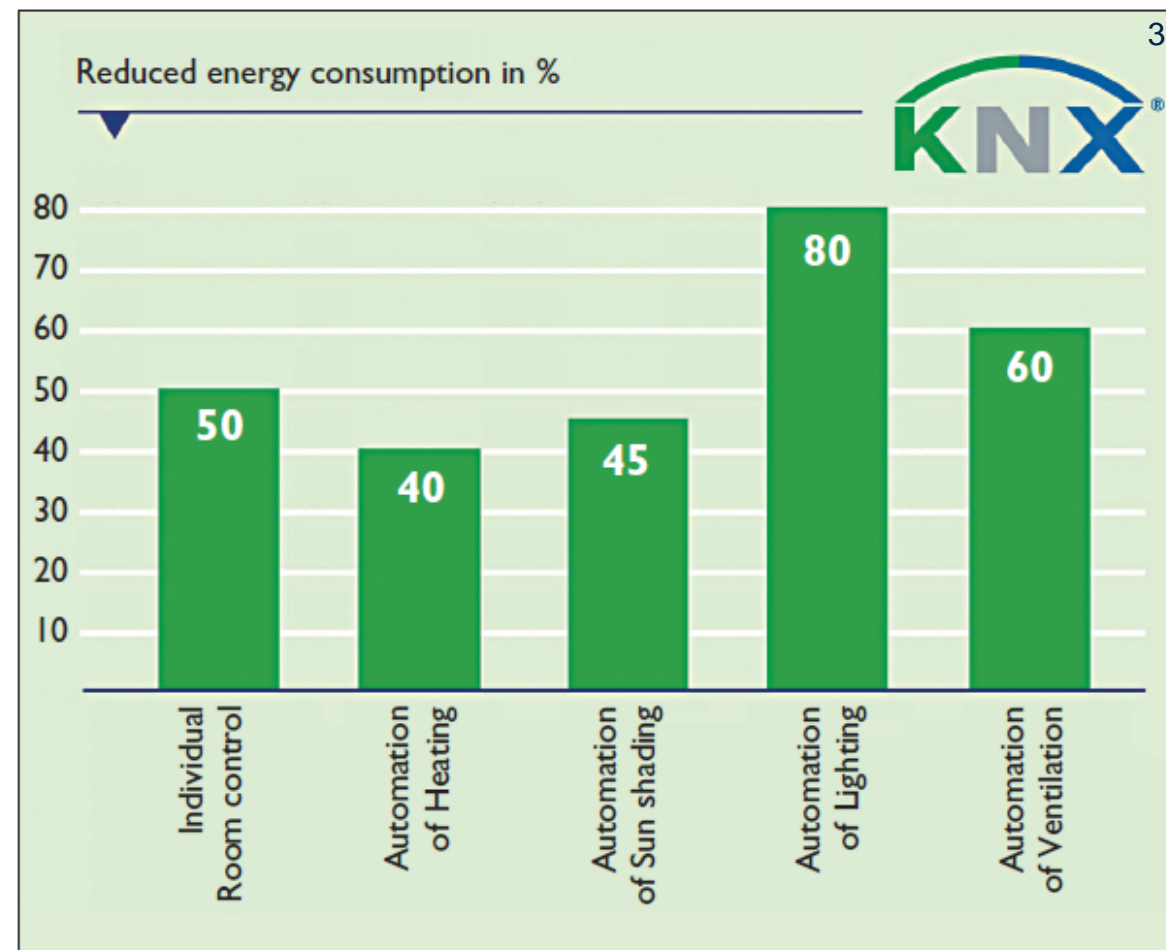
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Buildings energy consumption

Buildings consume
50% energy by 2030

Building energy
30%
Wasted

- Mendeley report: Buildings consume up to **40%** of the total global energy. By the year 2030, the consumption is expected to increase to **50%**.⁽¹⁾
- PRWeb report: **30%** of energy used in a commercial building is wasted because of inefficiencies.⁽²⁾





KNX market intelligence

GLOBAL KNX PRODUCT MARKET BY APPLICATION (USD MILLION) 2019-2031

Application	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	CAGR
Lighting	11719.8	9380.9	12330.7	13299.7	14448.1	15669.8	16957.8	18427.5	20076.1	22011.4	24418.1	27421.7	30959.0	10.0%
Blinds & Shutters	5052.7	4087.1	5372.3	5947.3	6452.2	7022.4	7662.3	8392.9	9206.4	10107.9	11125.4	12291.6	13615.5	9.8%
Security Systems	8466.9	7504.0	9863.5	10939.2	11768.7	12702.0	13744.1	14929.9	16241.5	17684.6	19304.5	21152.8	23239.3	8.9%
Energy Management	3258.7	2085.7	2741.5	2461.3	2663.0	2897.0	3171.4	3487.1	3843.9	4234.5	4649.3	5077.6	5529.2	9.6%
HVAC Systems	7388.2	5896.7	7750.8	8403.5	9057.3	9815.3	10704.2	11725.1	12876.0	14130.8	15456.0	16815.8	18241.3	9.1%
Monitoring Systems	1407.0	1138.1	1496.0	1461.3	1579.5	1716.5	1877.3	2062.2	2271.0	2499.3	2741.4	2991.1	3253.9	9.5%
Remote Control	1855.8	1501.1	1973.1	2162.7	2311.7	2476.4	2659.5	2867.8	3098.2	3355.4	3646.4	3973.7	4334.4	8.2%
Metering	1863.4	1498.5	1969.8	2175.1	2337.9	2521.0	2725.3	2957.8	3214.7	3497.1	3814.0	4175.4	4583.2	8.8%
Audio/Video Controls	3912.7	3247.7	4268.9	5114.4	5528.1	6009.8	6570.4	7203.0	7881.5	8610.4	9381.1	10202.5	11084.7	9.1%
White Goods	1975.6	1598.0	2100.5	2101.9	2263.9	2446.2	2649.9	2881.8	3138.5	3421.2	3738.8	4101.4	4511.0	9.0%
Total	46900.8	37937.9	49867.2	54066.4	58410.4	63276.3	68722.2	74935.1	81847.8	89552.6	98275.1	108203.7	119351.5	9.3%

- Global KNX products market size by 2031 will be above 119B\$ *1. Growth CAGR is around 9.3% (2019-2031).
- The market for Semi-conductor in the KNX Energy Management application is projected to reach **USD 130.9 million** for 2023 in Asia.
- WW TAM for KNX energy management product market in 2023 is 2.6B\$ and will double by 2031 at 5.5B\$

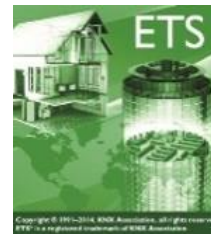


KNX in smart home and building automation

KNX is an open worldwide standard for home and building automation covering a range of products from many manufacturers

Approved standard:

- International standard (ISO/IEC 14543-3)
- European standards (EN 50090, EN 13321)
- US standard (ANSI/ASHRAE 135)
- **Chinese standard (GB/T 20965)**



500

KNX Manufacturers
in 45 Countries
8000 KNX Certified Products

103399

KNX Partners
in 171 Countries

499

KNX Training Centres
in 72 Countries

173

KNX Scientific Partners
in 36 Countries

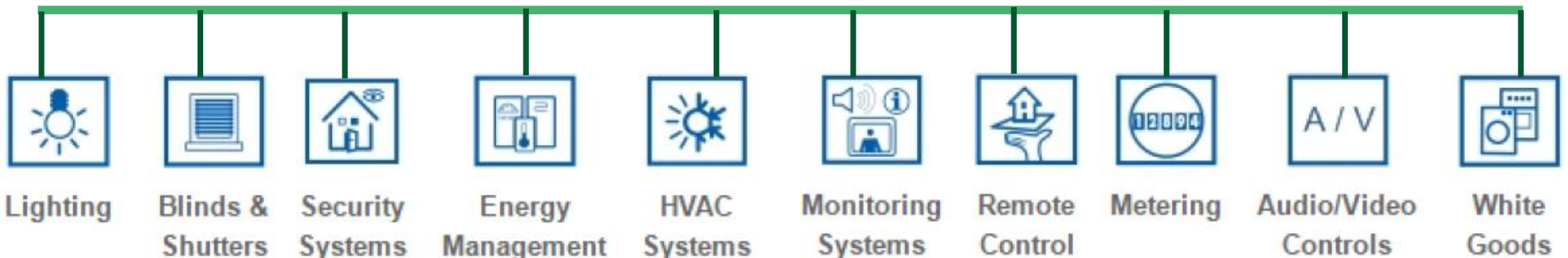
23 KNX Userclubs /
Professionals
in 20 Countries

24 Associated
Partners

45 KNX
National Groups

17 Test Labs
in 9 Countries




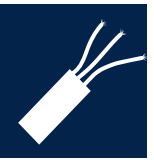
ETS Sold
in 155 Countries

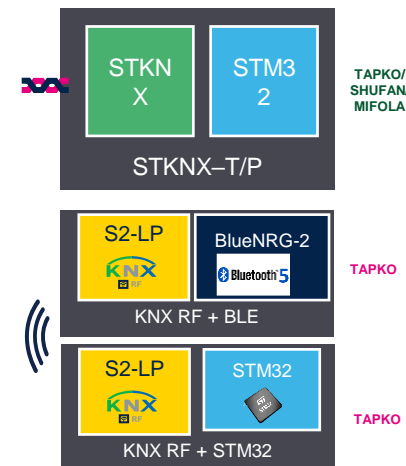




Connectivity medium options

ST delivers twisted pair wired and RF wireless solutions

		Medium	Transmission via	Preferred areas of application
		Twisted pair	Separate control cable	<ul style="list-style-type: none"> • New installations • Extensive renovations • Highest level of transmission reliability
		Radio frequency	Radio line	<ul style="list-style-type: none"> • When no cable can be installed
		IP	Ethernet/WIFI	<ul style="list-style-type: none"> • In large installations where a fast backbone is needed • For communication with mobile devices
		Powerline	Existing network (neutral conductor must be available)	<ul style="list-style-type: none"> • If no additional control cable can be installed • When 230 V cable is available

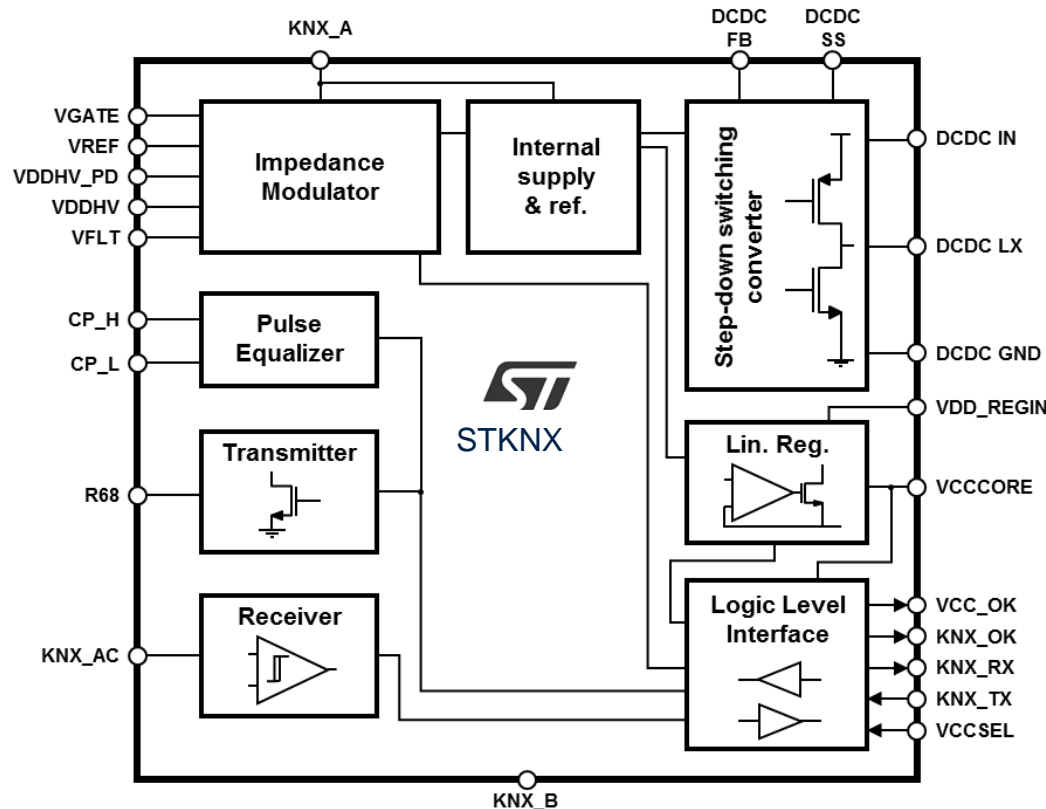
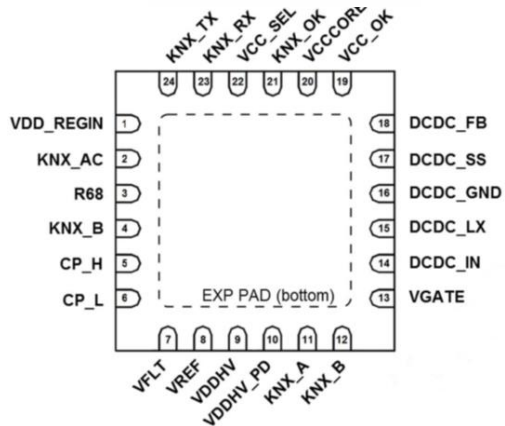




KNX TP solution – STKNX chipset

STKNX transceiver device for KNX TP communication; small package and few external components enable the very compact KNX nodes

4x4 VQFNPN
24-lead package

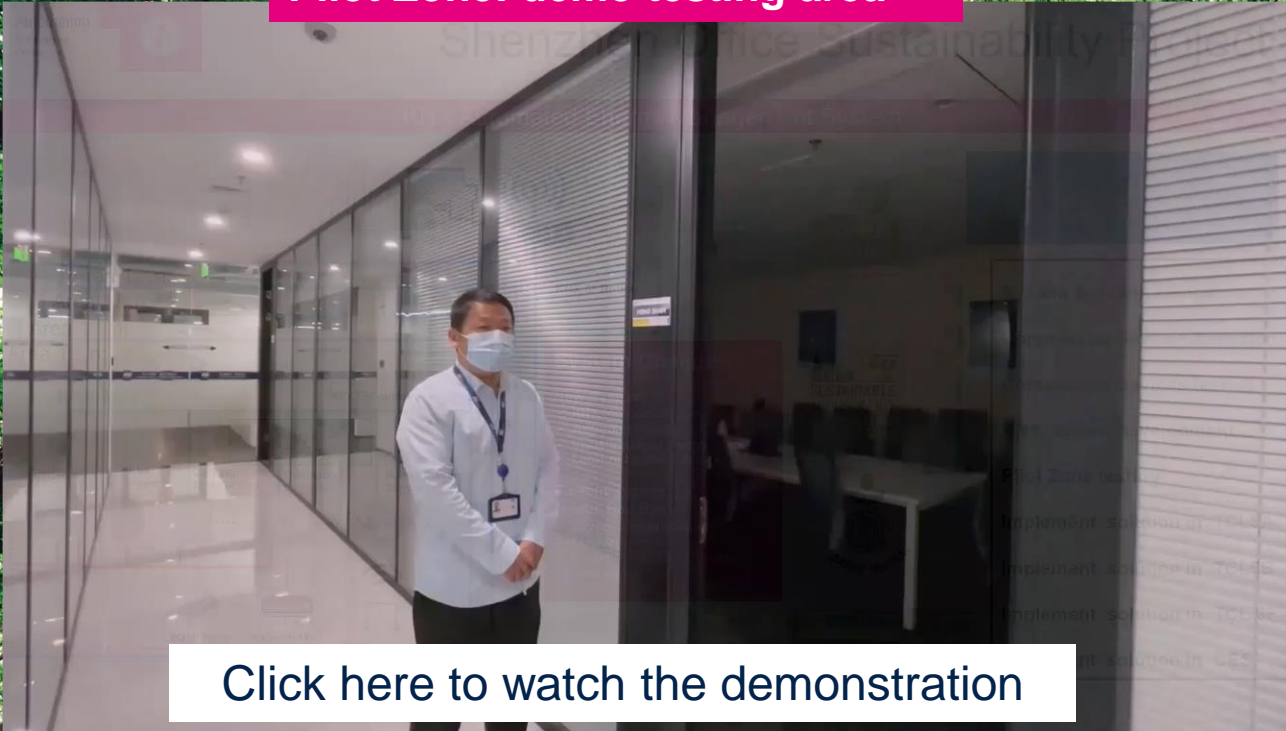


- KNX certified, KNX TP1-256 supported.
- Very small system solution
- Supports bus current up to 30mA (fan-in 3)
- Easy "Bit" interface to μ C
- No crystal required
- 2 integrated voltage regulators for external use in application.
 - Selectable 3.3V / 5V – 20mA linear regulator
 - Adjustable 1V to 12V – 150mA high efficiency DC/DC switching converter
- Recommended list of passive parts is supplied in datasheet and schematics



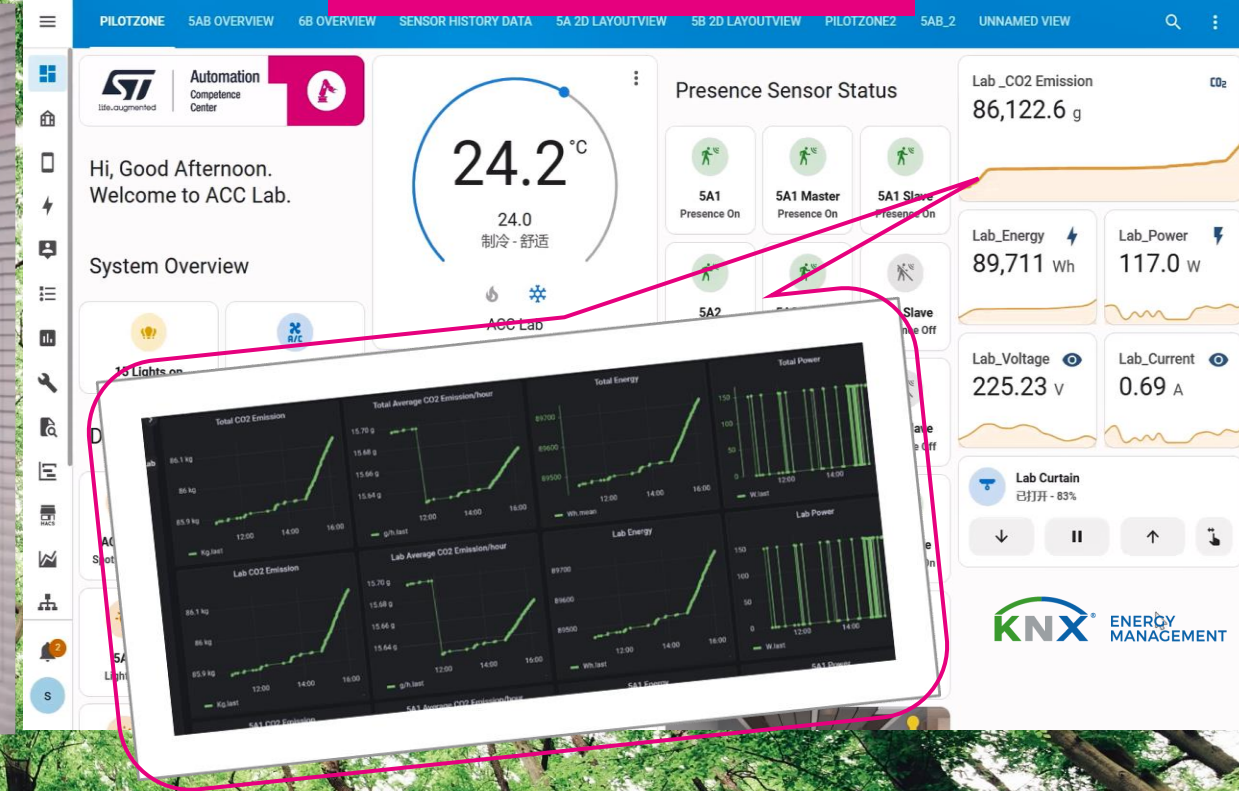
Smart building automation ST Shenzhen office sustainability project

Pilot Zone: demo testing area



[Click here to watch the demonstration](#)

Home assistant dashboard



KNX energy management system





KNX applications in energy management



Lighting



Heating, Ventilation
& Air conditioning
(HVAC)



Blind and Shutter
Control



Automation and
Remote Access



Security and Safety



Operation and
Visualisation



Energy
Management/Smart
Metering

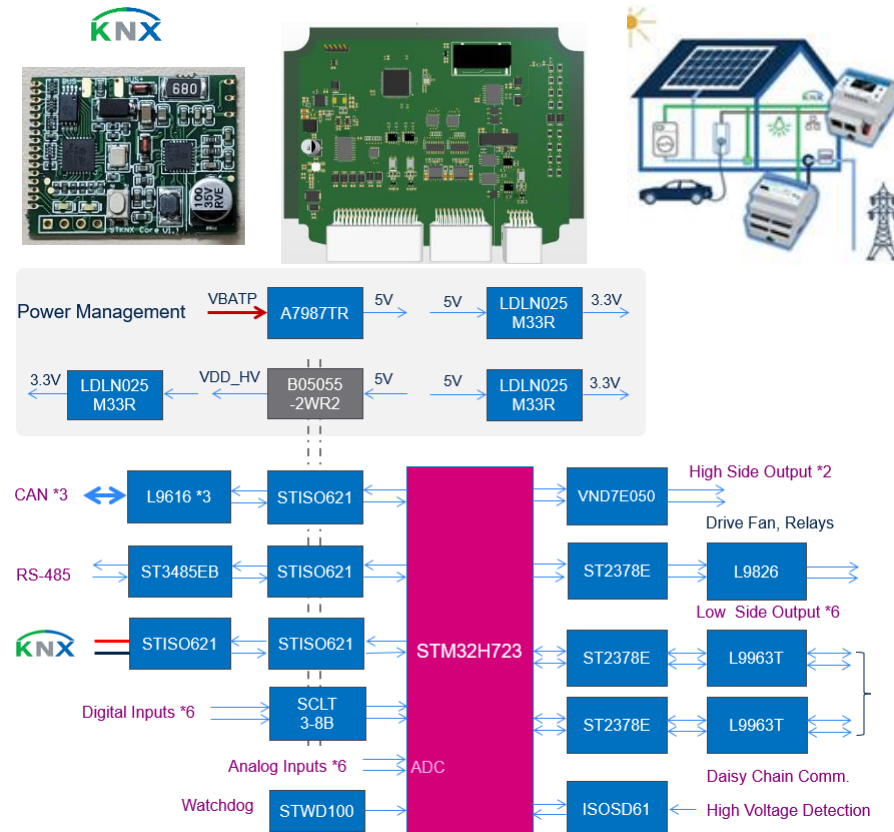


Other

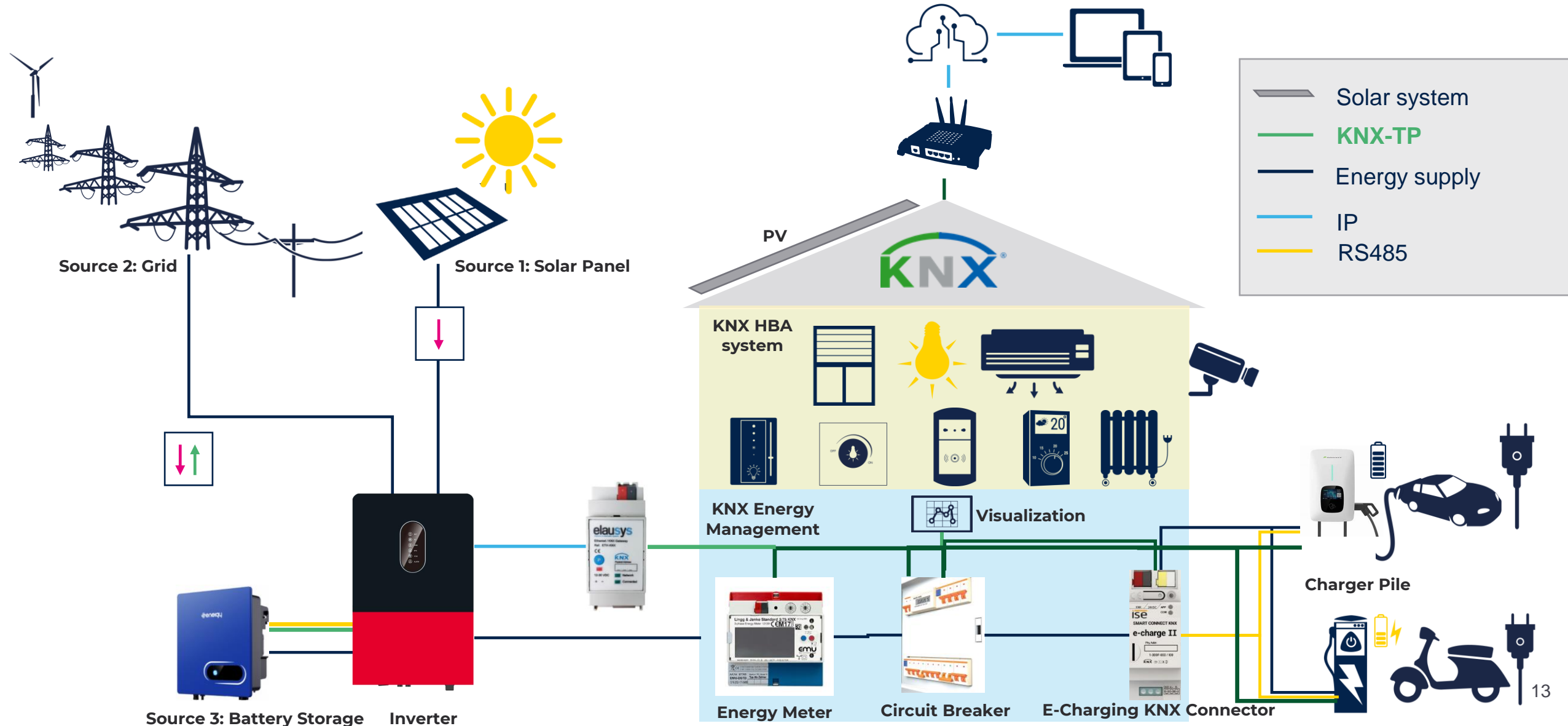




- **KNX energy Management:** metering , data Logging, visualization, current detection, fuel, or water tank level control, peak demand monitoring, load shedding, energy harvesting, renewable energies, battery storage

KNX applications



KNX energy management system



	KNX	RS485
Protocol	International standard (KNX SW/HW/Association/Protocol/ Cable/IC)	Proprietary protocol(DMX512/Modbus etc.) Physical layer (Electrical regulations)
Interoperability	Good	Need protocol docking and connector matching
Modulation	Modulation voltage up to 7V	Differential line with mV
Anti-static ability	Strong anti-static ability	Sensitive to static electricity
Device Power	KNX bus communication and power supply(<0.6W), Auxiliary power function	Need additional external power supply
Stability	Carrier monitoring capability, more stability	Without carrier monitoring function
Network structure	Bus, Tree, Star	Bus(Single master slave structure)
Network capacity	65536	255(Typical)
Security	KNX Data Secure & IP Secure	 

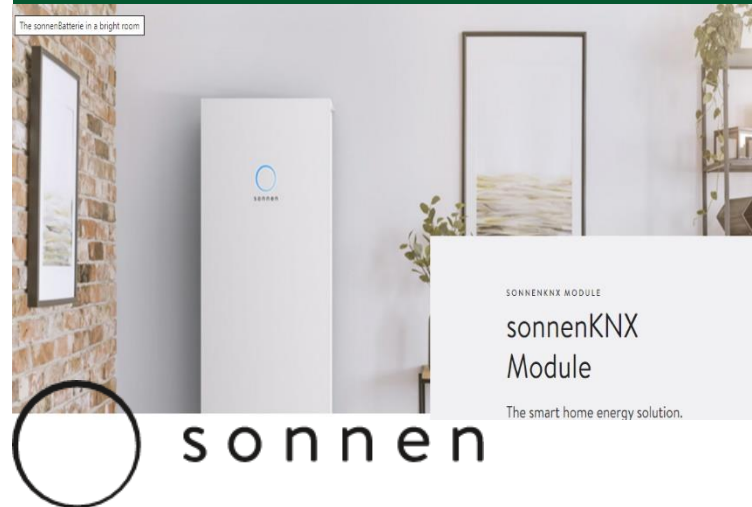
Enablers of KNX energy management

KNX gateway for solar inverters



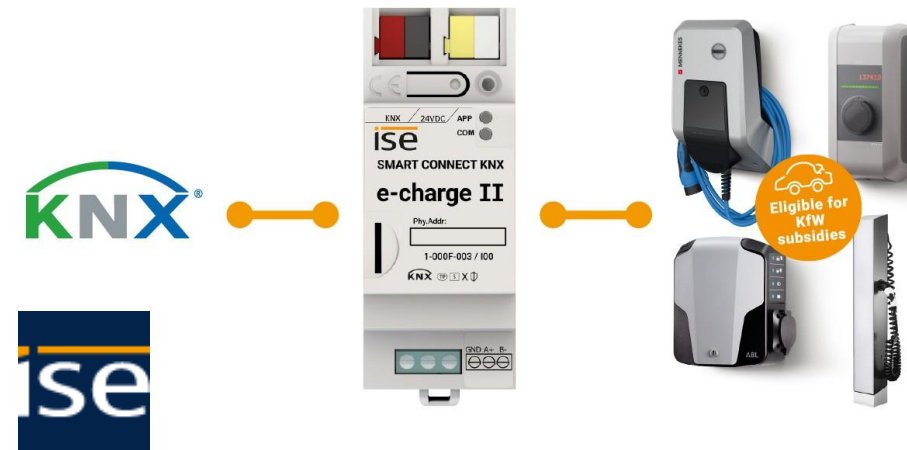
- KNX gateway for solar panel inverters
- [Elausys link](#)

KNX smart home energy solution



- A high-tech storage system that allows to cover about 75% of the yearly energy requirement with self-produced and clean energy
- [Sonnen link](#)

Electromobility in KNX smart home



- Dynamic load management and SMART CONNECT KNX e-charge II. Easily integrate up to 5 charging points from different manufacturers into the KNX.
- [iSE - link](#)

KNX with other protocols for energy planning using the grid or solar inverter

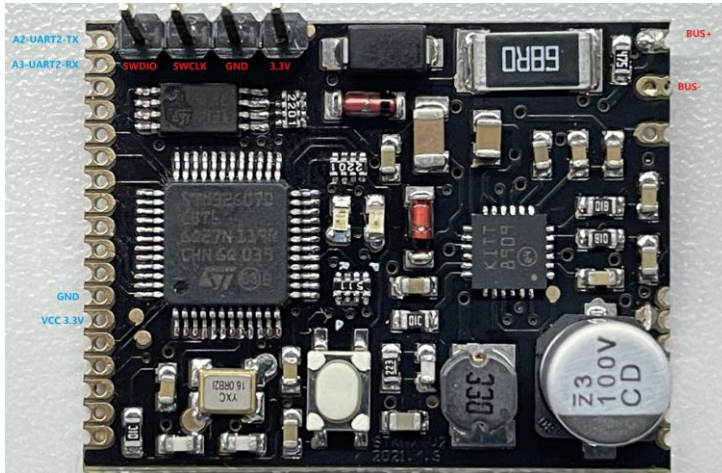


- E-HAUS HEMS (home energy management systems) show real-life appliances being managed by the Alexander Maier Eisbae.
- Multiprotocol gateway visualization, allowing KNX to be mixed with other protocols.
- Examples of different functional models were shown, such as EV charging and home energy planning.*

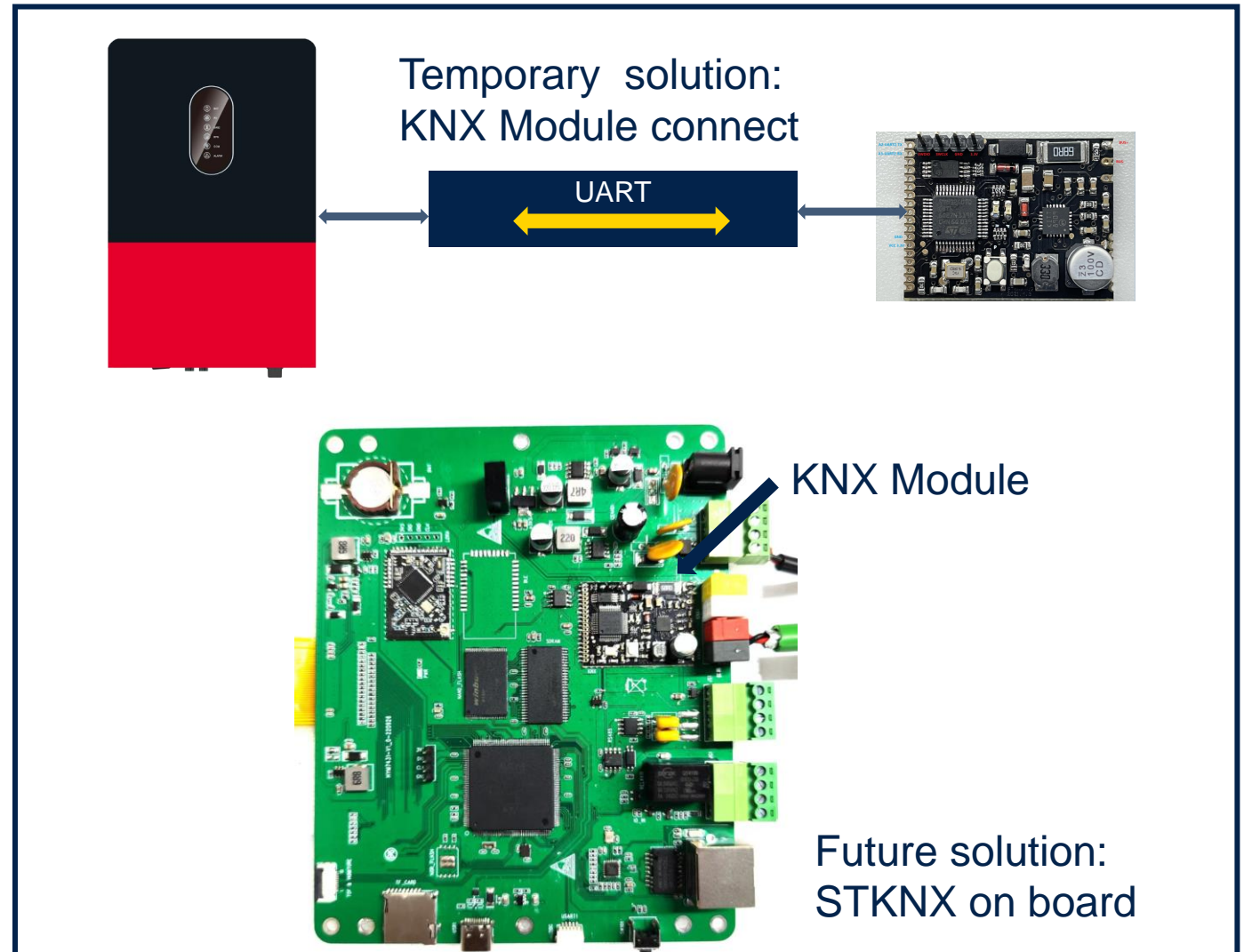
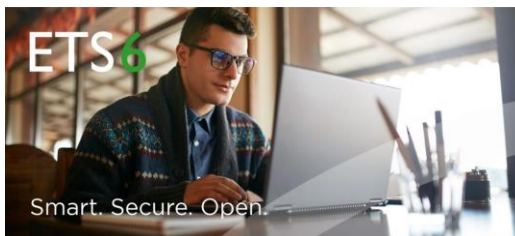


KNX solution implement

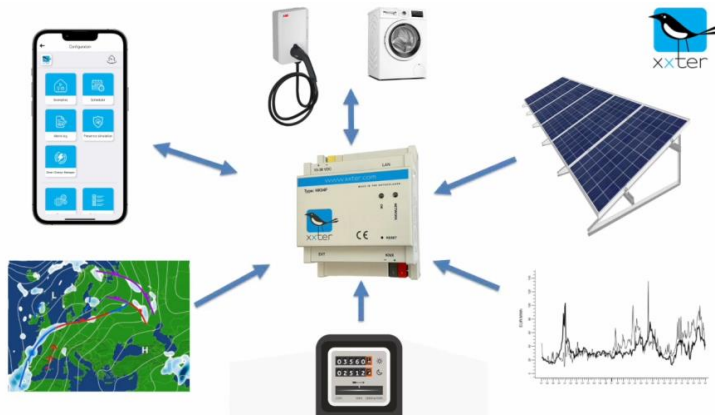
Use case:



55 KNX communication objects
and 18 UART communication
command have been included.



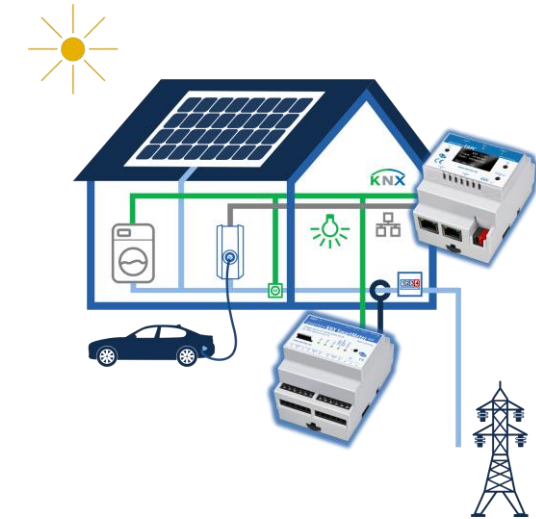
KNX use cases in energy management



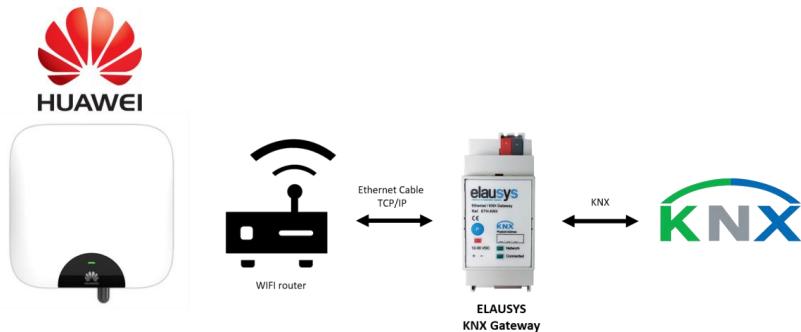
[XXTER KNX Smart Energy Management](#)



[HDL KNX Battery Energy Storage System](#)



[EibPC2 KNX Home Energy Management](#)



[Elausys KNX gateway for Huawei Inverters](#)



[Sonnen KNX Module for Smart Home Energy](#)

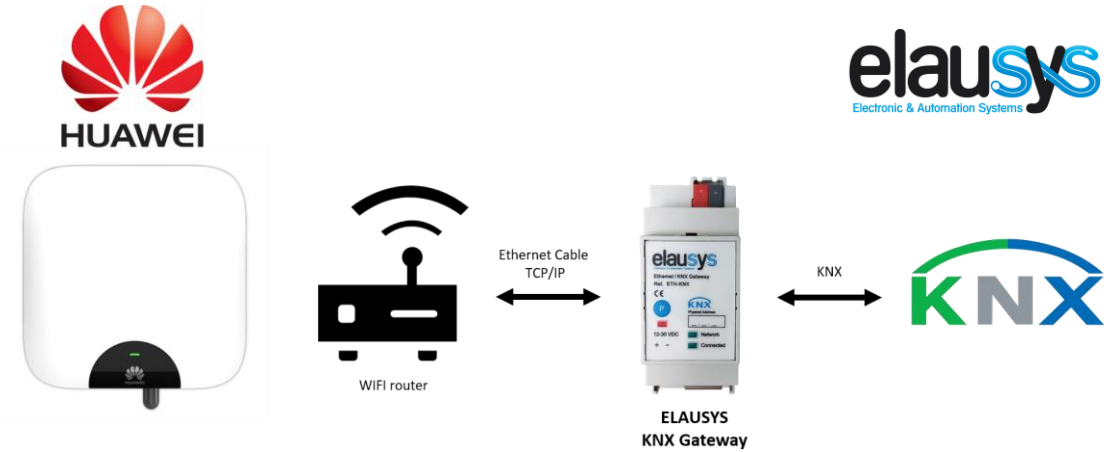


[myGEKKO Energy Manager](#)

KNX energy management selling points



- **Reduce Energy Costs:** Reduce energy costs up to 30% by optimizing energy usage
- **Optimize Energy:** Maximize the use of self-generated solar energy
- **Smart Charging:** Charge your electric vehicle and other devices when energy demand and prices are lowest
- **Smart Scheduling:** Run appliances when energy demand and prices are lowest
- **Carbon Reduction:** Reduce your carbon footprint

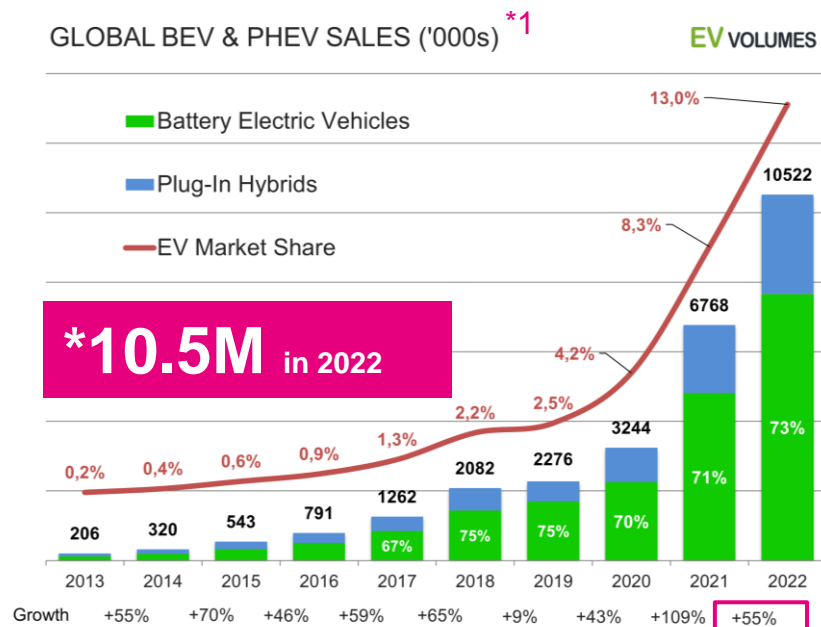


- KNX Interface for **Huawei SUN2000** inverter series
- Monitoring of **Energy, Power, current, voltage, frequency, temperature,...**
- Connected to the inverter over Ethernet
- **Galvanic insulation** from the **KNX** bus
- **Configurable** refresh rate of inverter data
- DIN rail mounted and Auxiliary power supply 12-30VDC
- **Advanced Logic functions** including weekly calendar, sequences, math, logic gates and triggers
- Different **KNX devices** from different **vendors** communicate without any problems

ST KNX EV charging station



Smart EV market and KNX charging stations



ABB

ABL

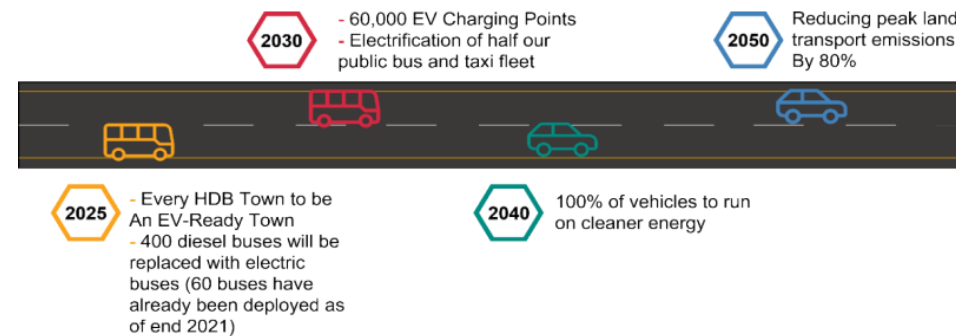
KEBA

MENNEKES

ebee
SMART TECHNOLOGIES ^{*2}

mobility
MADE BY STÖHR

SG GREEN PLAN ^{*3}



1. European Commission clear directions: an economy that envisages net-zero emissions for transport by 2050.
2. **10.5 million** new BEVs & PHEVs were delivered during 2022 in global. By the end of 2023, expect **40 million** EVs in operation.
3. Global sales of chargeable vehicles (**10.5 m**) were higher than for non-chargeable vehicles (**8.4 m**) for **the first time** in 2022.
4. **KNX Association** sees integrating **EV charging** as an important part of the energy management of homes and buildings
5. There are already KNX devices launched by KNX Members that allow a range of charging station brands to be connected to KNX, including already stations from **ABB, ABL, ebee, KEBA, Mennekes and Stöhr**.
6. Singapore's vision to have **all vehicles** run on cleaner energy **by 2040**.
7. **60,000** EV charging points by 2030, **40,000** charging points in public carparks and **20,000** charging points in private premises

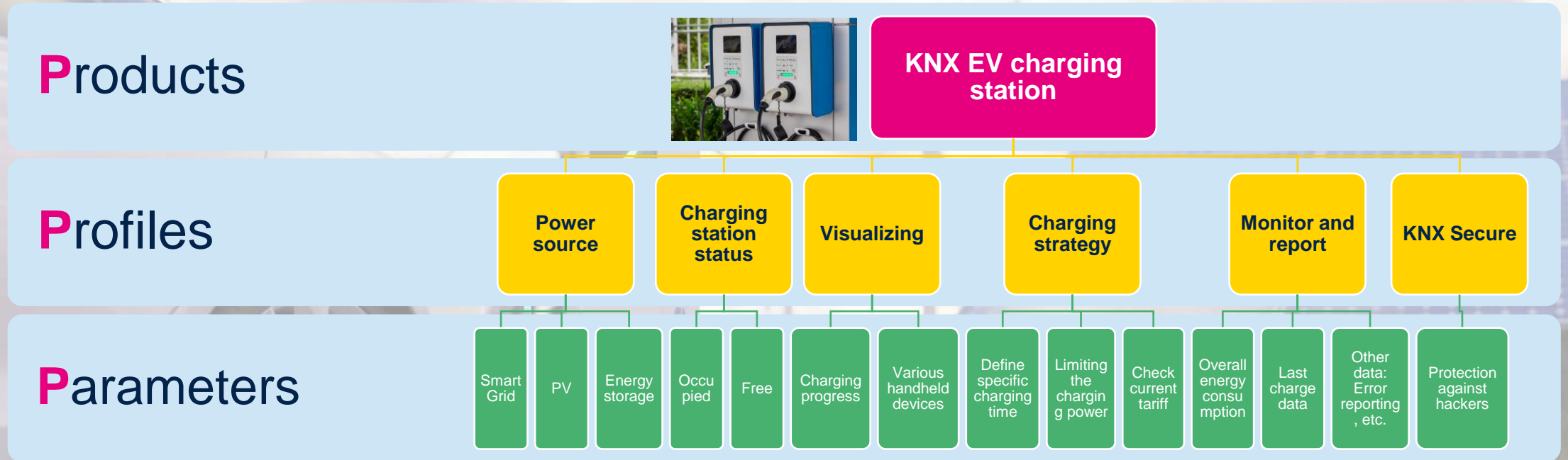
EV charging in parking space today

Maximizing idle charging stations usage with KNX energy management system



With KNX energy management system, we can maximize the usage of EV charging pile and number of EV car coverage per parking lots ²²

KNX EV charging station key profiles

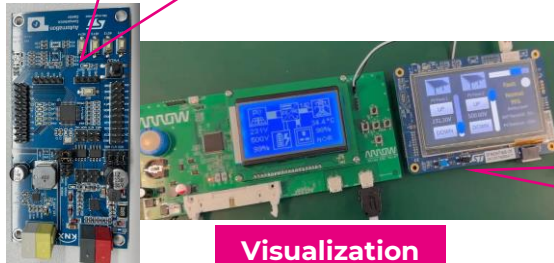


1. The EV market is clearly growing, and the demand for charging vehicles whilst at work/home will increase as the market expands.
2. **KNX** provides the mechanism to do this intelligently and securely, by integrating the charging of EVs within an energy management system that already **covers all aspects** of a home or building's **energy consumption and generation**.
3. **07B0h KNX stack** is a recommend KNX configuration profile for EV charging station device, more than **2000** communication objects & parameters are supported by this profile .



KNX energy management EV charger topology

STM32G070
STKNX
STISO621/620



STM32H750
STDS75

Visualization



KNX Energy Management System



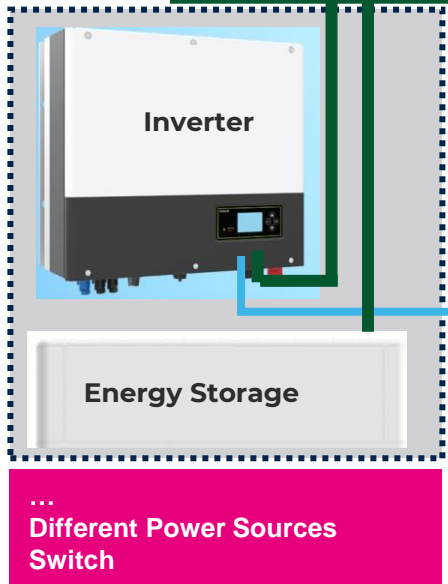
Gateway and Router



KNX IP Router



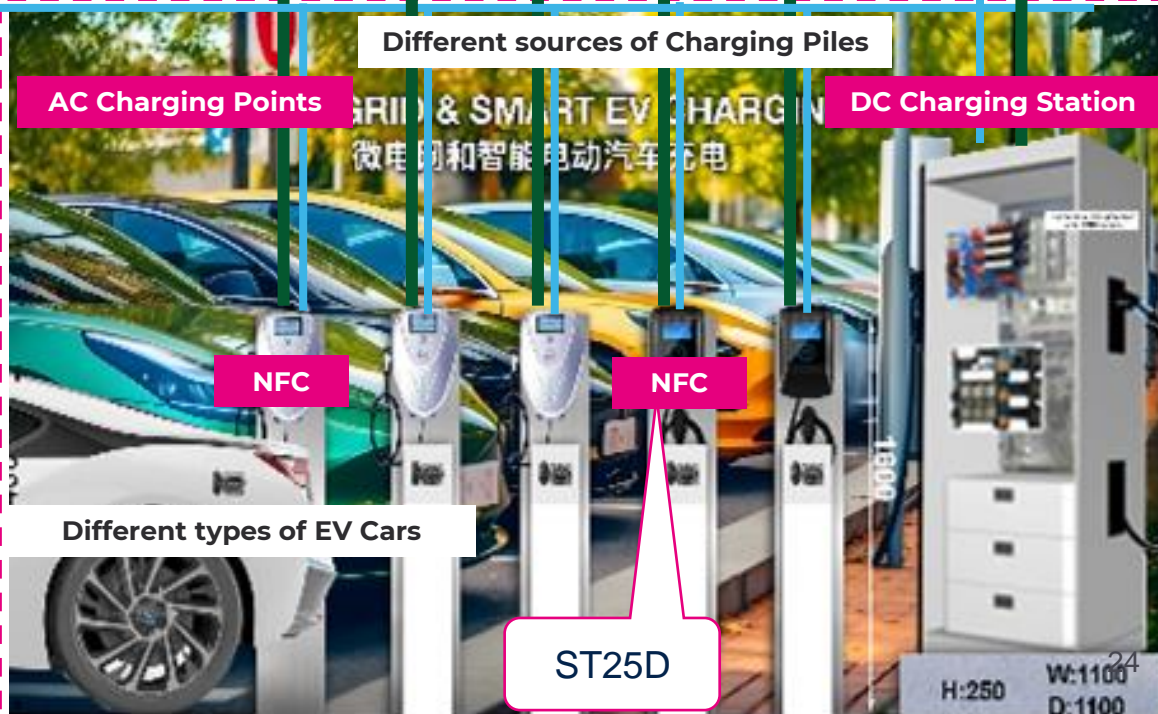
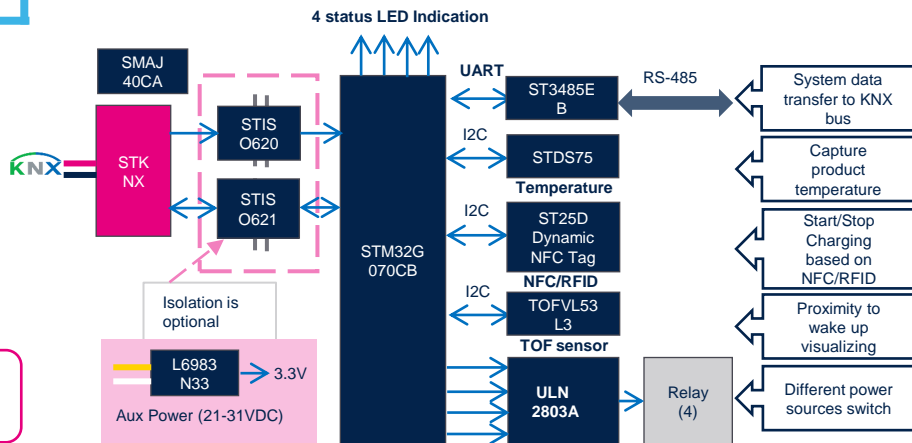
HBA and Home Appliance



Meter



KNX Power





Charging station in KNX smart parking energy management system

Note: need to check the Charging port standard required in the country of installation

AC
Source

Dual power automation
transfer switch

DC
Source

200-750VDC

AC
Source

AC220V±15%

DC EV Charger Station
(120KW)

AC EV Charger
(230Vac, 3/7/9/12KW)
(400Vac, 11/22KW)



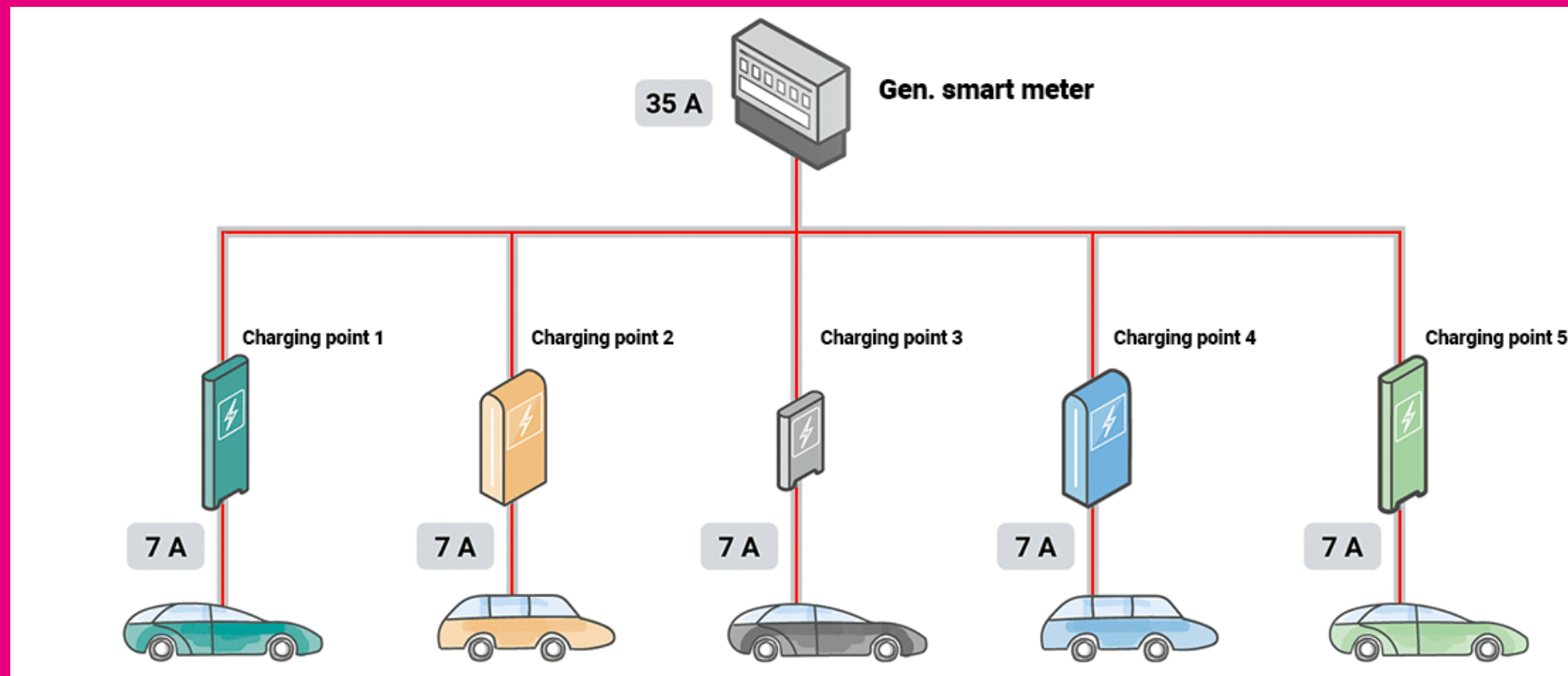
KNX Energy Management System:

1. Provides **Status** and **Power consumption** of Charging
2. Start/Stop Charging based on **NFC/RFID**
3. Different automation **power sources** switch
4. Automatic distribution of **charging current**
5. Provides management of Energy from one Charging Station to another
6. Improves **Intelligent utilization** of Charging station reducing the idle EV chargers in peak hours
7. KNX **Secure** adds more protection in the IP and data transfers
8. Up to **65,000** nodes can be manage by KNX
9. Visualizing for charging progress, payment and error reporting, etc..
10. And more....



KNX energy management system solution

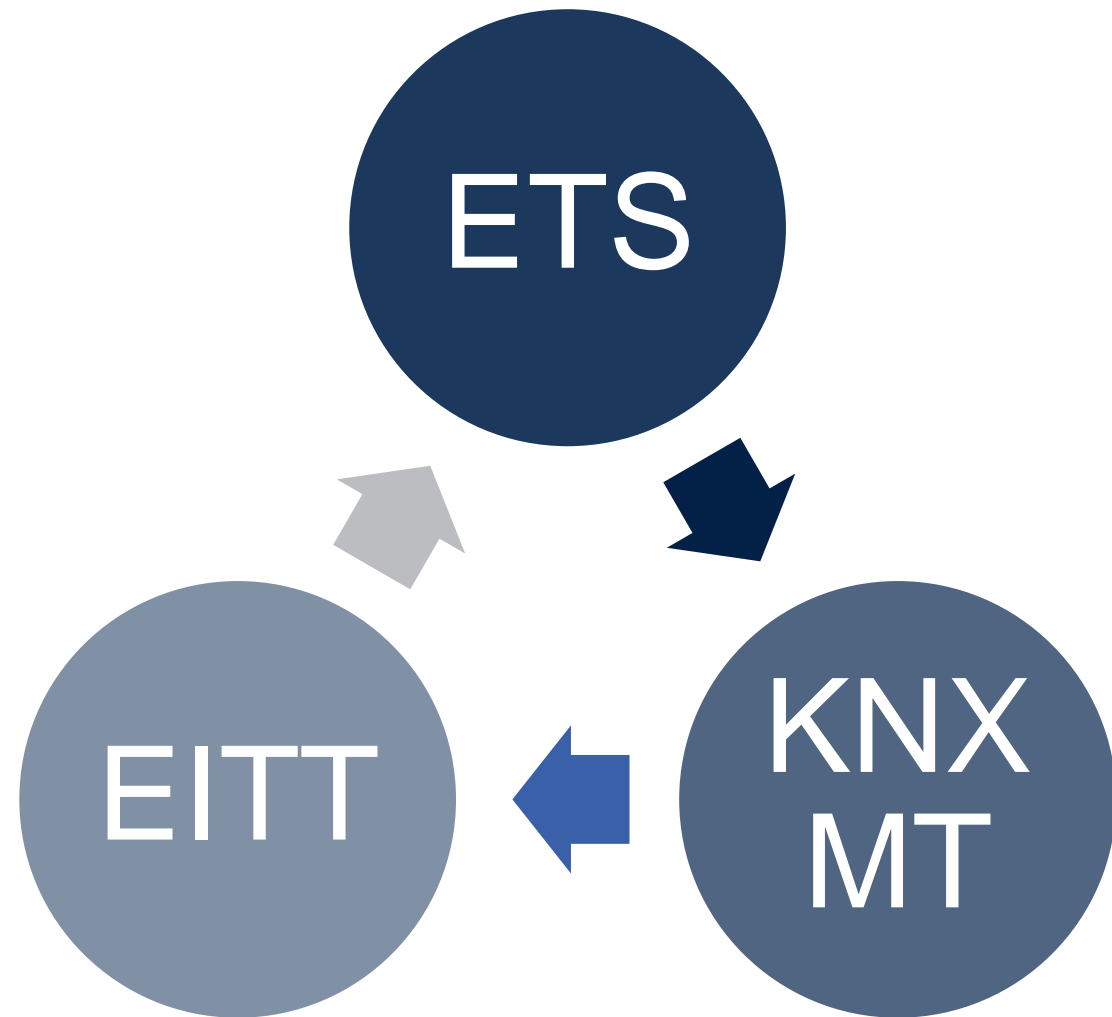
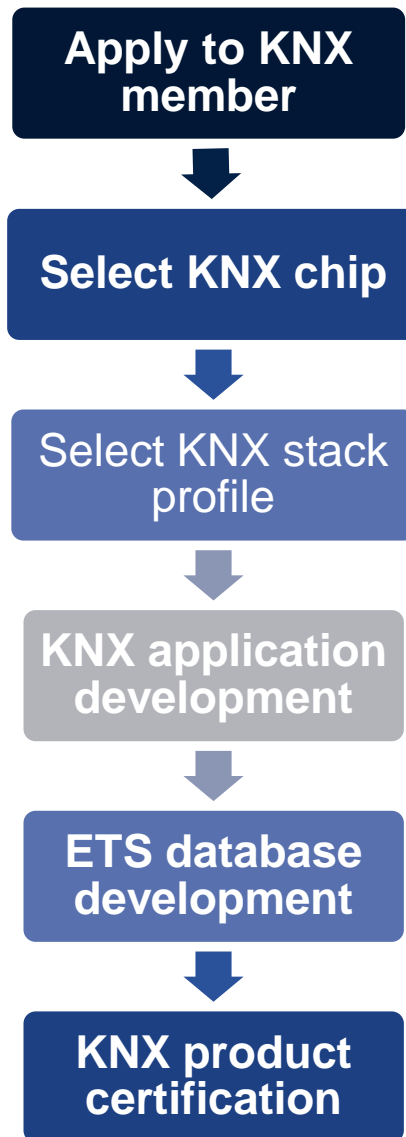
Example of KNX System



ST KNX solutions and development process

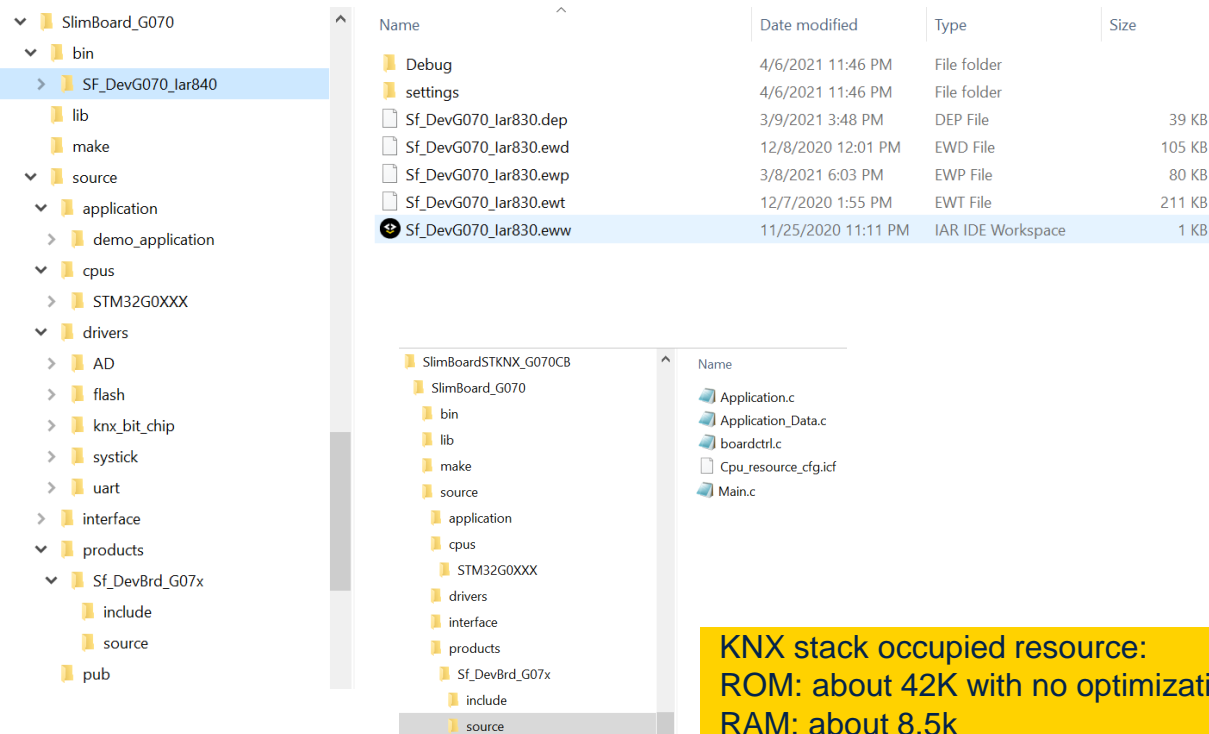


Activity and tools for KNX product development



SHUFAN stack plus STM32G070CB

1. Get Shu Fan KNX stack project



2. Refer to SHUFAN KNX Stack user manual for KNX Part FW design

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SHUFAN stack plus STM32G070CB

3. Create S19 file via S19 Generation tool



MakeKnxS19_ST_stm32xxx.exe

4. Refer to Shufan KNX Tool reference specification for creating ETS database.

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In-	Number	Internal Name	Text	Func.	Object Size	Priority	Flags	Datapoint Type	Internal Description
#1	0000h	In1-Switch	In1-Switch		1 Bit	Low	RWCTU	[1.1] DPT_Switch	
#2	0001h	RSC1-Dimming	RSC1-Dimming		4 Bit	Low	RWCTU	[3.7] DPT_Control_Dimming	
#3	0002h	ASC1-Dimming	ASC1-Dimming		1 Byte	Low	RWCTU	[5.1] DPT_Scaling	
#4	0003h	In2-Switch	In2-Switch		1 Bit	Low	RWCTU	[1.1] DPT_Switch	
#5	0004h	RSC2-Dimming	RSC2-Dimming		4 Bit	Low	RWCTU	[3.7] DPT_Control_Dimming	
#6	0005h	ASC2-Dimming	ASC2-Dimming		1 Byte	Low	RWCTU	[5.1] DPT_Scaling	
#7	0006h	In3-Switch	In3-Switch		1 Bit	Low	RWCTU	[1.1] DPT_Switch	
#8	0007h	In3-Force	In3-Force		2 Bit	Low	RWCTU		
#9	0008h	In3-Scene	In3-Scene		1 Byte	Low	RWCTU	[17.1] DPT_SceneNumber	
#10	0009h	In4-Switch	In4-Switch		1 Bit	Low	RWCTU		
#11	000Ah	In4-Force	In4-Force		2 Bit	Low	RWCTU		
#12	000Bh	In4-Scene	In4-Scene		1 Byte	Low	RWCTU		
#13	000Ch	Out1-ONOFF	Out1-ONOFF		1 Bit	Low	RWCTU		
#14	000Dh	Out1-Status	Out1-Status		1 Bit	Low	RWCTU		
#15	000Eh	Out2-ONOFF	Out2-ONOFF		1 Bit	Low	RWCTU		
#16	000Fh	Out2-Status	Out2-Status		1 Bit	Low	RWCTU		
#17	0010h	Out3-ONOFF	Out3-ONOFF		1 Bit	Low	RWCTU		
#18	0011h	Out3-Status	Out3-Status		1 Bit	Low	R-CT-		
#19	0012h	Out4-ONOFF	Out4-ONOFF		1 Bit	Low	RWCTU		
#20	0013h	Out4-Status	Out4-Status		1 Bit	Low	R-CT-		

Numbe	Name	Object f	Description	Group Add	Length	C	R	W	T	U	Data Type	Priority
#10	In1-Switch				1 bit	C	R	W	T	U	switch	Low
#11	RSC1-Dimming		New group address 1/1/1		4 bit	C	R	W	T	U	dimming control	Low
#12	ASC1-Dimming				1 byte	C	R	W	T	U	percentage (0..100%)	Low
#13	In2-Switch				1 bit	C	R	W	T	U	switch	Low
#14	RSC2-Dimming				4 bit	C	R	W	T	U	dimming control	Low
#15	ASC2-Dimming		New group address 1/1/2		1 byte	C	R	W	T	U	percentage (0..100%)	Low
#16	In3-Switch		New group address 1/1/3		1 bit	C	R	W	T	U	switch	Low
#17	In3-Force				2 bit	C	R	W	T	U		Low
#18	In3-Scene				1 byte	C	R	W	T	U	scene number	Low
#19	In4-Switch		New group address 1/1/4		1 bit	C	R	W	T	U		Low
#20	In4-Force				2 bit	C	R	W	T	U		Low
#21	In4-Scene				1 byte	C	R	W	T	U		Low
#22	Out1-ONOFF				1 bit	C	R	W	T	U		Low
#23	Out1-Status				1 bit	C	R	W	T	U		Low
#24	Out2-ONOFF				1 bit	C	R	W	T	U		Low
#25	Out2-Status				1 bit	C	R	W	T	U		Low
#26	Out3-ONOFF		New group address 1/1/3		1 bit	C	R	W	T	U		Low
#27	Out3-Status				1 bit	C	R	-	T	-		Low
#28	Out4-ONOFF		New group address 1/1/4		1 bit	C	R	W	T	U		Low
#29	Out4-Status				1 bit	C	R	-	T	-		Low
#30	Dimmer1-Relatively		New group address 1/1/1		4 bit	C	R	W	T	U	dimming control	Low
#31	Dimmer1-Absolutely				1 byte	C	R	W	T	U	percentage (0..100%)	Low
#32	Dimmer2-Relatively				4 bit	C	R	W	T	U	dimming control	Low
#33	Dimmer2-Absolutely		New group address 1/1/2		1 byte	C	R	W	T	U	percentage (0..100%)	Low

SHUFAN stack plus STM32G070CB

5. Through STM32CubeMax or STM32Cube_FW integrated with other HW driver code.

STM32CubeMX Untitled

File Window Help

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New Project

MCU/MPU Selector Board Selector Example Selector Cross Selector

MCU/MPU Filters

Part Number

Core

Check/Uncheck All

☐ Arm Cortex-A7 + Arm Cortex-M4

☐ Arm Cortex-M0

☒ Arm Cortex-M0+

☐ Arm Cortex-M3

☐ Arm Cortex-M4

☐ Arm Cortex-M4 + Arm Cortex-M0+

☐ Arm Cortex-M7

☐ Arm Cortex-M7 + Arm Cortex-M4

☐ Arm Cortex-M33

Series

Check/Uncheck All

☐ STM32F0

☐ STM32F1

☐ STM32F2

☐ STM32F3

Features Block Diagram Docs & Resources Datasheet Buy Start

★ STM32G0 Series

STM32G070CB LQFP48

STM32G070CBTx

MCUs/MPUs List: 129 items

Part No.	Reference	Marketing Sta.	Unit Price for 10kU...	Board	Package	Flash	RAM	ID
★ STM32G041F8	STM32G041F8Px	NA	NA		TSSOP20	32 kBytes	8 kBytes	27
★ STM32G041F8	STM32G041F8Px	NA	NA		TSSOP20	64 kBytes	8 kBytes	27
★ STM32G041G6	STM32G041G6Ux	NA	NA		UFQFPN28	32 kBytes	8 kBytes	26
★ STM32G041G8	STM32G041G8Ux	NA	NA		UFQFPN28	64 kBytes	8 kBytes	26
★ STM32G041J6	STM32G041J6Mx	NA	NA		SO8N	32 kBytes	8 kBytes	18
★ STM32G041K6	STM32G041K6Tx	NA	NA		LQFP32	32 kBytes	8 kBytes	30
★ STM32G041K6	STM32G041K6Ux	NA	NA		UFQFPN32	32 kBytes	8 kBytes	30
★ STM32G041K8	STM32G041K8Tx	NA	NA		LQFP32	64 kBytes	8 kBytes	30
★ STM32G041K8	STM32G041K8Ux	NA	NA		UFQFPN32	64 kBytes	8 kBytes	30
★ STM32G041Y8	STM32G041Y8Yx	NA	NA		WLCSP18	64 kBytes	8 kBytes	27
★ STM32G070CB	STM32G070CBTx	NA	NA		LQFP48	128 kBytes	36 kBytes	43
★ STM32G070KB	STM32G070KBTx	NA	NA		LQFP32	128 kBytes	36 kBytes	29
★ STM32G070RB	STM32G070RBTx	NA	NA	NUCLEO-G070RB	LQFP64	128 kBytes	36 kBytes	59
★ STM32G071C8	STM32G071C6Tx	NA	NA		LQFP48	32 kBytes	36 kBytes	44
★ STM32G071C8	STM32G071C6Ux	NA	NA		UFQFPN48	32 kBytes	36 kBytes	44
★ STM32G071C8	STM32G071C8Tx	NA	NA		LQFP48	64 kBytes	36 kBytes	44
★ STM32G071C8	STM32G071C8Ux	NA	NA		UFQFPN48	64 kBytes	36 kBytes	44

STM32Cube_FW_G0_V1.3.0

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Documentation

Drivers

> BSP

> CMSIS

> STM32G0xx_HAL_Driver

> Middlewares

Projects

> NUCLEO-G031K8

> NUCLEO-G070RB

> NUCLEO-G071RB

> STM32G071B-DISCO

> STM32G081B-EVAL

> STM32G0316-DISCO

Name

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License.md

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Release_Notes.html

6. Develop product application control logical part. Most of development effort will focus on this part.





21IC training center for automation

https://www.21ic.com/stpower/training_center/#video_automation_c



ST KNX solution contributes to the sustainable development target



Home and building automation – Internet of Everything



ST KNX-RF solutions



How to quickly develop a KNX product based on ST KNX and STM32G0 MCU



STMicroelectronics Industrial automation and robotics solution



How to quickly develop a KNX product based on ST KNX and STM32G0 MCU



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